

PIG LOVERS AND PIG HATERS: PATTERNS OF PALESTINIAN PORK PRODUCTION

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ABSTRACT.—The Biblical injunction against the pig makes the discovery of remains of this animal on Near Eastern archaeological sites singularly worthy of comment. Various explanations for the origins of the food taboo have made use of sketchy and anecdotal evidence of ancient Palestinian pig exploitation. This more organized review of the available pig bone evidence suggests that the pattern of pork consumption is tied to a complex web of environmental, political and agricultural factors, forces whose individual explanatory power varies with the historical period examined. Thus, if behavior shaped the institution of the Biblical food rules, it will first be necessary to determine the period when the rules became part of the transmitted tradition before the material factors affecting that legislation can be isolated.

RESUMEN.—La prohibición bíblica contra el cerdo hace singularmente digno de comentario el hallazgo de los restos de este animal en sitios arqueológicos del Cercano Oriente. Las diferentes explicaciones del origen de estos tabus alimenticios han empleado evidencia incompleta y anecdótica de la explotación de cerdos en Palestina antigua. Esta vista mas organizada de la evidencia disponible sobre huesos porcinos sugiere que el patrón de consumo de carne de marrano se relaciona a una red compleja de factores ambientales, políticos, y agrarias. El poder explicativo de estas fuerzas varía según el período histórico estudiado. Por lo tanto, si el comportamiento diera forma al establecimiento de las reglas alimenticias bíblicas, será necesario averiguar primero cuando el reglamento se hizo parte de la tradición transmitida antes de que se puedan aislar los factores que afectaron esa legislación.

RESUME.—La prohibition biblique contre le cochon rend notable la découverte des restes de cet animal dans les sites archéologiques de l'Orient Proche. Les explications différentes pour l'origine de ce tabou alimentaire ont usé l'évidence incomplète et anecdotique pour l'exploitation ancienne du cochon palestinien. Ce sommaire plus organisé de l'évidence disponible chez les os du cochon suggère que cette modèle pour la consommation du porc s'est liée a une toile complexe des facteurs environnementals, politiques, et agricoles. Le pouvoir explicatif de ces facteurs change avec la periode historique examinée. Donc, si la conduite a formé l'establissement des règles bibliques de l'alimentation, on doit premièrement déterminer l'époque quand les règles se sont devenus une partie de la tradition transmise avant d'isoler les facteurs materiels qui ont affecté a cette législation.

DEDICATION

The departments of anthropology at the University of Alabama and the University of Alabama at Birmingham conduct a unique cooperative graduate program. Many bureaucrats were openly skeptical when the idea to expand the University of Alabama's program to include the faculty and students at Birmingham was first broached. They were not without evidence. Many proposed joint campus ventures had sunk without a trace over the years; parochialism could have killed this one as well. However, their prediction did not consider the power of inter-faculty cooperation. To forge the spirit of trust that makes cooperative programs work, Earle Smith, in both his roles as a senior member of the faculty and head of the department at the University of Alabama, worked tirelessly to build bridges between our campuses. One of the ways he achieved results stimulates this paper. Annually our departments gather to discuss the program. Often these events have been held at Moundville, Alabama's impressive archaeological site and public park. Faculty attendance was never a problem since these were opportunities to sample and savor Earle's pork barbecue as well as discuss academic issues. Differences of opinion seemed to waft away as the smells from the grill drifted into the conference room. An important basic social rule applied: shared food reinforced shared interests. Earle's success stands in sharp contrast to the following discussion of pigs and people, where food is an institution that often keeps people apart.

INTRODUCTION

The discovery of pig remains in historic period excavations in Palestine inevitably inspires comment. These treatments are, more often than not, devoted to explaining why the bones are intrusive or otherwise not associated with the period, place and people under investigation. From a simple materialist point of view, it is not obvious why this should be. The pig, wild and domestic, has been an indigenous part of the wildlife of the Middle East for millennia. Moreover, the hog is recognized worldwide as a productive resource, since it couples rapid rates of growth and reproduction with a tractable nature into a suitable package for both small and large scale husbandry. Thus it would be fair to predict that the discovery of the remains of this creature in archaeological sites in Palestine should excite little interest outside the circle of animal bone specialists. But, of course, the pig's productive potential is not the whole story. We are also aware of the texts and traditions which demand that the pig be avoided by two of the three major religious communities of the region. The existence of these food rules, dietary restrictions that seem at least arbitrary and perhaps counterproductive to observers in Europe and America who are outside these faiths, has stimulated a vast literature concerned with the origins and meaning of pig avoidance.

Pig bones, as they have been encountered in various excavations, have been used as historical ammunition in many of these discussions of the food rules. Probably because bones were not routinely collected by archaeologists until recently (Dever 1983, note 9, p. 582), much of this interpretation of the meaning

of pig remains in the animal bone record of Palestine has been unsystematic. Most importantly, estimations of past patterns of boar hunting, hog husbandry or pig sacrifice have not been linked to an understanding of ancient animal husbandry systems as wholes. Recent work has begun to change this. A number of sites now have been sampled more or less intensively for bones. Data from these excavations can be used to sketch an outline of the history of pig use in Palestine. It is now reasonable to ask whether the regional patterns that we are beginning to discern are any help in understanding the origins of the food traditions and prohibitions.

PIG THEORIES

The reasons that the pig is prohibited for Muslims and Jews have been the source of debate for centuries (for instance, see the survey in Hunn 1979). In addition to those models which specifically invoke unverifiable religious forces as explanation for the rules of pig avoidance or offer allegorical accounts, there are other propositions which incorporate such cultural factors as ideology, ethnicity, and economic behavior together with environmental factors into models potentially testable with archaeological data. The explanations fall into two broad clusters—(1) Cultural Historical: those which depend on the ideological or ethnic identification of the prohibitors, and, (2) Cultural Ecological: those which do not, suggesting rather that the Palestinian examples of pig taboo are special cases of broader ecological or political processes. Within the clusters, each type of explanation has a different potential relationship to the archaeological record. Briefly summarized these are some of the alternatives:

(1) *Ethnic/Political*.—A culture's identity is interwoven with its foodways (Bökönyi 1975, Reitz and Honerkamp 1983). Insofar as one society disdains an adjacent group, it will choose not to emulate that neighbor's cuisine. Frederick Zeuner (1963:261), for instance, enthusiastically refers to Antonius's explanation of the Israelite taboo when he writes, "[A]s the pig is valuable to the settled farmer only, the nomads, who have always felt superior to the farmer, came to despise the pig as well as the farmer who bred it. In due course, they developed religious prohibitions against the animal they themselves could neither breed or keep."

The pig principle of Antonius can be applied directly to the behavior of Israelites in Canaan if one is willing to accept one of the widely accepted models of Israelite settlement, that this Late Bronze Age–Early Iron Age¹ event was a process of sedentarization of former nomads [see Finkelstein's (1988a, 1988b) and Fritz's (1987) recent elaborations of this theory]. Given the additional assumption that foodways are conservative cultural features that would survive the sedentarization process, the archaeological implications are clear: pigless garbage might be the detritus of Israelites, pork bones certainly mean the Philistines (amongst others).

But nomadic roots for the Israelites are not universally accepted. Other authorities review models where the "proto-Israelites" were actually settled Canaanites or migrating, in the sense of a one-time movement, rather than nomadic, invaders see, for instance, the discussions of Aharoni (1982), Gottwald (1979),

Lemche (1985), Yadin (1979), Yurco (1990). If one of these hypothesized historical processes turns out to be true, and nomadic proto-Israelites are rejected, one can salvage the principle of ethnic disdain by generalizing to a suggestion that pigs and pig products were the purview of some social class or sector within Canaanite society. Also, political fragmentation and subsequent resettlement in a new ethnic geography could generate cuisine disdain as peoples suddenly discover they have new and different neighbors (I am reminded of the Assyrian policy of extensive community relocation, one they applied during their region-wide domination during the later part of the Iron Age.²) Using either argument, it is easy to move to the archaeological proposition that pigs will be absent from the garbage of prohibiting ethnic communities and present in that of their enemies. The distribution of pig bones will be found to be a "map" of political relations between groups with different subsistence traditions. Of course the problem now becomes one of explaining how sharply divergent subsistence traditions can emerge in similar environments.

Success in applying this model to the excavated record in a more than perfectly circular manner requires an ability to identify not only the ethnicity of architecture and ceramics but also communal garbage pits as well, a problem likely to be very difficult in large complex multi-ethnic communities. Further, the date when the two cultures and cuisines came into contact must be specified to evaluate the proposal as an explanation of origins. As an archaeological problem, however, this explanation has the distinct advantage of requiring a positive pattern. Since pig disdain is seen as a response to pig love, analysis needs to discover places where pork production was embraced so as to provide the stimulus for the vocal disgust of the prohibitors.

(1) *Ethnic/Religious*.—De Vaux provides an alternative—and more familiar—process for the development of the taboo, one that is rooted in religion. He concludes from his survey of prehistoric and historic pig related behavior that the Biblical expression of revulsion for the pig derived from much more ancient divisions in Canaanite cultic practice,

The most likely answer is that the prohibition is pre-Israelite in origin and that it was preserved in Israel after its religious origins were forgotten. After all, Jews and Muslims of today abstain from eating pork without knowing why, except that it is forbidden by the Torah and by the Koran. And it is quite possible that this revulsion for the pig, which became second nature to the Israelites, was reinforced by the ritual usage which they saw made of it in certain pagan rites.

(de Vaux 1972:267)

In this case the archaeological challenge is to identify the 'ritual' use of pigs by the Israelites' neighbors and antecedents. This would provide evidence for a practice which could have been abhorred by some during the Bronze Age, making it a source for a tradition that later was transmitted to the Bible where we see them in the Levitical and Deuteronomic documents in texts which achieved the form we have the today only centuries later. As will be discussed, some of the

suggested evidence for 'cultic pigs' founders on the shoals of animal bone identification.

(1) *Symbolic/Linguistic*.—Douglas (1966) argued that the pig is prohibited because of the anomalous position it holds within the structure of animal classification reflected in the Bible and the relationship taxonomic anomaly has to the basic concepts of purity central to the Israelite ideology. The pig is only one of many potentially defiling animals. It is singled out for special mention not because it is more defiling than other forbidden animals, but because of the possibility of classificatory confusion. From an archaeological point of view this is a variant on the Ethnic/Political explanation (see above). For archaeological evaluation it shares the same problems of determining ethnic identity in the excavation record. On the other hand it has the advantage of greatly expanding the list of species whose distribution should be similar to that of the pig—animals such as the hare, camel, hyrax, donkey, and all the carnivores. However, since the origins of the taboo are found to be within a culture rather than a byproduct of its external relations, a different approach to predicting its archaeological appearance is necessary. The additional requirement is that the linguistic process which evolved the pig's (and other animals) anomalous position within the classification and the ideological web within which it fits is sufficiently well understood historically to predict when an emerging set of food prohibitions might have had behavioral consequences.

(2) *Environment*.—Because of the particular requirements demanded by the physiology and behavior of pigs, these animals are missing from the larders of those who occupy hot, dry climates and from the herds of those whose lifestyle is migratory or nomadic (Harris 1974, 1985). Given what is known about climatic change and past environment, the ecological model produces specific expectations about the potential distribution of pork production. Foodways, once established, are viewed as highly conservative cultural features. Following the same line of argument as Antonius, Harris (1985) also suggests that those communities with food traditions forged in arid climes might find political reason to continue these foodways even after entering well-watered habitats. Though Harris does not mention it, one can also suggest that the foodways of immigrants from pig loving lands would also be maintained as a tradition in the new home. This might appear as an extra emphasis on pork production in regions where pig raising is minimally practicable.

(2) *Initial Settlement*.—This last point can be generalized by placing it in the context of overall pastoral management. The productive capacity of pigs make them ideal initial barnyard stock for settlers establishing themselves in a new land. Crabtree (1989:210) illustrates this point with the evidence from Anglo-Saxon West Stow:

One of the main problems that . . . settlers would have faced was establishing their herds of domestic animals. Since pigs mature quickly and multiply rapidly, they are ideal animals for colonizers. A somewhat higher reliance on pigs in the early 5th century may have allowed the

West Stow farmers to build their herds more rapidly. Once adequate stock levels had been established, the early Anglo-Saxon settlers would have shifted their attention away from pigs and increased the numbers of cattle and sheep . . .

The archaeological application of this principle will require finely stratified samples. Practically speaking for tell sites such as are common in Palestine, the advent of pig use will be clearly identifiable, its abandonment less so as the processes of redeposition have usually taphonomically transformed the samples (Hesse and Rosen 1988).

(2) *Hygienic*.—Many authors have considered the possibility that the taboo was related to the pig's potential role as a vector for disease, usually trichinosis. Although difficulties with this proposition have been dealt with by Harris (1974), it is interesting to note the discovery of a *Trichinella* cyst in a ca. 20th Dynasty mummy (Hecker 1982, citing Millet *et al.* 1980).

(2) *Agricultural*.—A central problem of husbandry is balancing the needs of the animals with those of agriculture. Feed must be provided either through shifting potential cropland to pastureland or through the processing of agricultural byproducts. As agriculture intensifies, the first option becomes less attractive. Pork production, however, will continue to flourish as long as the crops selected are those which produce abundances of plant refuse. However, as those crops (basically the grains) are replaced by those with smaller refuse fractions, pork production becomes marginally less efficient compared to the husbanding of other animals such as sheep and goats at a distance, in pastures inaccessible to pigs either because of the difficulty in herding large numbers of them or the quality of the terrain. This economic reality may underlie Coon's (1958) suggestion that an emphasis on olive and vine production will depress pork production [see the discussion of agricultural byproducts in Preston *et al.* (1985) and Sansoucy (1985)]. Since Palestinian agricultural production evolved and specialized in those directions with geographically diversified emphases (Stager 1985), we may hypothesize that animal husbandries responded to the changes in a like manner.

(2) *Political*.—In complex societies animal production takes place within the context of a market or other complex redistribution system. These institutions are likely to attract the attention of central administrations as a source of revenue. Pigs and pork are a poor choice for fulfilling the taxation needs of these governmental bodies because the animals produce few secondary products and the primary product is difficult to store. The spoilage potential of pork is probably overstated since procedures outlined in *De agricultura* by Cato (234–149 BC) in section CLXII, 1–3, indicate the antiquity of ham curing in the Mediterranean world. It would be useful to know when the technique was first known in the Levant.

Diener and Robkin (1978) argue that pigs are the domestic animal of choice of small (often rural) householders, selected in an attempt to achieve a degree in independence from the onerous demands of ruling elites [see also Coon (1958)].

Governments seek to discourage these pigsties and their informal marketing arrangements by establishing regulations and by appealing to widely held ideals. The ethnographic work of Kluck (1983:143) illustrates how this works in Brazil where:

The sale of lard and sausage is supposed to be taxed and subject to rigorous licensing—so rigorous as to prohibit *de facto* their sale. The stated rationale for such a policy is hygienic. This concern for public health varies seasonally, however. Its implementation is most rigorous in November–December when the municipal government is most severely strapped for funds . . . Farmers in towns lacking meat packing plants do not face similar restrictions. The policy has therefore created a flourishing *sub rosa* trade in the sale of sausage and lard . . . The ways they have devised for avoiding the government agents attempting to enforce this policy are legion, and the nature of sausage and lard allows them more room to maneuver than would milk."

There are several important implications of this theory for Palestine in the historic periods. The first being that pig production would tend to be stifled in times of powerful central administration and more widespread during periods of the exercise of local power. Second, in all periods when pig husbandry is present at all, it should have been more common in the rural sectors. This is because small producers would likely have attempted to avoid total engulfment in the centralized economy by shaping their household husbandry to emphasize the consumable (commodity) value of animals rather than their use as items of exchange (currency) in a taxation and market system. Third, justification for the anti-pig policies is likely to have been couched in sacred terms where the validity of the government was interwoven with religious values. The rate of pig consumption thus becomes an indirect index of the involvement of central governments and others interested in maximizing tax offtake from local producers in local subsistence systems.

With this review of pig theories in hand, the purpose of the remainder of this paper is to survey the archaeological evidence for pig exploitation in the Levant and identify the patterns associated with various periods. This information can then be employed to evaluate some of the proposed explanations for the distribution of pig use and abuse in Palestine.

THE NEAR EASTERN PIG

The pig has a long history of habitation in the Levant. In Tchernov's survey of Quaternary fauna he notes the presence of the Villafranchian pig *Sus strozzi* (Kurten 1968:154–155) in Preglacial Pleistocene levels in the Bethlehem conglomerate (Tchernov 1979:261). The earliest record of the modern species of pig *Sus scrofa* is recorded from Benot Ya'akov in Middle Acheulean levels (Tchernov 1979:264) and in a host of later Pleistocene deposits (Tchernov 1979:267–269) including Tabun and Hayonim.

Taxonomy and Distribution.—Modern wild pigs have been surveyed by Harrison (1968) and Groves (1981). They identify two subspecies of distinctive appearance, *Sus scrofa attila* Thomas, 1912, and *Sus scrofa libycus* Gray, 1868, for the Middle East. The first and larger of the forms is found in Iraq, Iran, and regions to the north of the Black, Caspian, and Aral seas. The latter ranges south from Anatolia and Syria (Groves 1981:28, Fig. 6.),

“into Israel, where Tristram said that it used to swarm in all thickets by the Jordan and the Dead Sea, extending even to the bare wilderness of Judaea. He also noted it from the Waters of Merom: Mt. Tabor: Carmel; Rr. Kishon; Sharon Plain; Wadi Arnon and Jabbok. Bodenheimer said that it still occurs in Upper Galilee, especially in the Hula thickets and in the Araba and that it had disappeared in the coastal plain where it had been noted at Petah Tikvah, near Jaffa as well as at Rass el Ein and in Jordan from Wadi Hanna near Nablus; Salfit mountains; Fallik; Shooni T-J and Jisr Damia Bridge. Hart saw them near Beersheba and found them abundant in the northern Negev between the Ghor and Gaza.”

(Harrison 1968:375, his references omitted)

Groves (1981:28) identifies the wild pig population of the Nile Delta with this second subspecies as well. Uerpmann's (1987:42) review of the archaeological record of wild boar in the Middle East reinforces these observations: “Although highly adaptive to many different biotypes, the wild boar is not an animal of the arid deserts. It was and is present along the Euphrates valley, but there is no indication that it penetrated deeply into the Arabian Peninsula. Most of the sites on the eastern slopes of the Levantine mountains have not yielded any *Sus* remains, nor were pigs identified at the sites in eastern Arabia.”

It is clear from this geographic survey that wild pigs occupied most of the regions of the Levant, including dry and rough terrain not usually associated with the species, even though they favor dense thickets and marshes along permanent water courses. Some populations move into hill slope woods during the winter season (Harrison 1968:375). Based on descriptions of Iraqi boar behavior they are agricultural pests, doing great damage to crops, particularly cereals, during night raids (Harrison 1968:375).

Domestication and Osteometry.—Of the three subspecies of *Sus scrofa*, *S. s. scrofa*, the European wild boar, is the smallest, *S. s. libycus* is intermediate, and *S. s. attila* the largest. The relative sizes of the various subspecies of pigs are important to this discussion because the primary method used to determine archaeologically the domestic or wild status of the pig from isolated bone fragments is size. Husbanded animals are smaller and show some degree of facial shortening compared to wild examples, a trait often marked additionally by the absence of a premolar.

Flannery (1983:169, Table 3) has published a list of measurements of Near Eastern pigs. Within this list there is a great deal of overlap between the thirteen skeletons from Iran and Iraq and the eight from Syria and Israel. However, though the difference may result from chance in such small samples, the arithmetic means

of specific measurements taken on the two groups of pigs are different. For example, considering the length of the lower third molar, the average is 41.62mm, SD=2.8 for 13 specimens in the first group and 39.38, SD=4.6 for the second. If these differences are repeated in larger samples, it will be important to be clear which wild standard is employed in determining the wild/domestic status of a particular archaeological specimen in order to establish a conservative decision point. Further, the effects of age-related change and sexual dimorphism on the interpretation of measurement distributions complicates the issue (Payne and Bull 1988). Given the smaller size of the wild population in the Levant, reasonable measurement ranges for wild Levantine suids should lie somewhere between those given by Flannery (1983:170) for the whole Near East and those suggested by Boessneck *et al.* (1963) for European pigs.

The successful application of these measurement criteria to particular archaeological questions assumes that the wild populations are flourishing in typical habitat and remain isolated from domestic stock. Groves (1981:41, Note 4, his reference omitted) points out that, "[D]omestic pigs can remain healthy and fertile on a diet which stunts their growth almost beyond belief. If the same applies to wild pigs, then crowding and sub-optimal diet on small islands could explain small size without any change in gene pool . . ." If the scattered pockets of 'good pig country' near the limits of the distribution of the pig in the Near East acted like islands, or the smaller populations in the southern Levant experienced much gene inflow from feral individuals, both reasonable possibilities, then there is a real possibility of the presence of wild populations of smaller animals, creatures available to be taken by hunters on an occasional basis. Nurkin (n.d.) has illustrated this point. He measured a sample of wild pigs from Sedom in the Tel Aviv University collections. The range of lengths of the lower third molar he found was 28.5–40.6 mm with a mean = 36.2 mm and SD = 3.6, values well below both the southwest Asian average (both subspecies) and the subset of what were probably *Sus scrofa libycus* suggested by Flannery. Thus, at the limits of the distribution of the wild pig in Palestine and when the specimens are few, relying solely on osteometrics to determine the domestic status of swine in archaeological remains can be risky. For this reason verification usually demands the discovery of pig related artifacts [such as pens (Hecker 1984)] or evidence that the pig cull matches the practice of swineherds rather than the take of boar hunters, i.e., an abundance of young in the slaughter (see the cautionary notes of Lauwerier 1983).

Unfortunately the published record for pig bones in Palestine is spotty with respect to these three attributes—osteometry, mortality, and artifacts of husbandry. In the archaeological review that follows, only rarely will I be able to identify with certainty the domestic or wild status of the exploited pigs.

Requirements of Domestic Swine.—No better description of the basic needs of domestic pigs can be found than that provided by Columella (*Res rustica* VII, 6–8),

Moreover, pigs can make shift in any sort of country wherever situated. For they find suitable pasture both in the mountains and in the plains, though it is better on marshy ground than on dry. The most convenient feeding-grounds are woods . . . For these ripen at different times

and provide plenty of food for the herd almost all the year round. But where there is a lack of trees, we shall have recourse to fodder which grown near the ground and prefer muddy to dry ground, so that the pigs may root about in the marsh . . . Sows indeed grow fat on cultivated ground when it is grassy and planted with fruit-trees of several kinds . . . You should not . . . be sparing of the contents of the granary, which should often be handed out when out-door food fails.

Successful swineherding is associated with rainfall or moist ground, the presence of mixed deciduous forest, and the availability of reserve fodder collected from agricultural activities. It is thus clear that evaluating the potential for pork production in various parts of Palestine will require a knowledge of the history of local environmental conditions and crop choices, a subject just beginning to be broadly undertaken.

THE NATURE OF ARCHAEOLOGICAL PIG SAMPLES

Significance.—Before turning to an examination of the Palestinian pig bone record, some attention must be given to the methods of determining what is a "significant" datum. The foregoing résumé of wild pig geography makes it clear that pigs were a potential part of the diet almost anywhere in the Levant. It is also true that non-human agents, dogs and other scavengers for example, are responsible for some of the accumulations found at archaeological sites. Thus, any measurement of the importance of the pig in some period or at some place within Palestinian archaeology is a mixture of context evaluation and quantitative technique directed toward the two questions: (1) Does a sample have enough pig bones to make it significant?, and (2) Were bones found in a context that draws attention?

The most obvious was to tackle pig "significance" with archaeological remains is by looking for pig abundance, this on the theory that the level of contribution to the economy will be mirrored in the ideology. However, a cautionary note should be sounded. Consider Shanklin's (1983:11) review of goats among the Kom of Cameroon:

Goats are "valuable" in that their monetary worth is considerable, but, unlike the cattle kept by Fulani pastoralists in the area, for example, goats are not "valued" or held in high esteem. In a culture in which several animals are esteemed for their "intrinsic" merits . . . there are no representations of goats (or chickens), no folk tales or proverbs that deal with or even mention them . . . There are two kinds of goats, said one informant, goats and sheep. Sheep have certain magical characteristics but goats have none.

In the absence of a textual setting, nevertheless, considerations of abundance may be the only possible approach, and certainly it is one that should not be cast out of hand.

Regional Perspectives.—The subsistence systems of the Levant were and are diverse (Hopkins 1985). Depending on the local environment, a varying mixture of village based agro-pastoralists and nomadic pastoralists can be expected. Each end of this continuum is associated with different animal management mixes. One classification relevant here was developed by Grigson (1987:232) in her study of the Negev Chalcolithic. She has defined two strategies—one, tied to the possibility of rain fed agriculture mixes sheep, goats, cattle and pigs in the barnyard; the other, located in more arid climes where some form of irrigation is necessary, drops the pig from the herd list. This dichotomy is important for it points out that adjacent communities in complex landscapes may practice divergent husbandry practices (Flannery 1983:183) and that it will require samples from a regional array of sites to establish a subsistence pattern.

Sampling Complex Distributions.—The individual activities which make up the process of animal exploitation are spatially segregated. Animals are pastured or foddered in one location; milked, shorn, or worked in another; slaughtered in a third; butchered in yet a fourth; prepared into meals in a fifth; have their bodies turned into tools in a sixth; and finally have the debris of all this processing activity scattered across the various dumps of the community. For pig remains in Palestine, the parade case of this kind of bias is the famous pig from Hazor (Angras 1956). The skeleton of this much noted find is represented only by head and trunk, the limbs from the carcass having been transported and deposited elsewhere.

Additionally, different sectors of complex societies have variable access to the numerous resources provided by all this processing (Wapnish *et al.* 1977, Zeder 1988). A community with significant economic specialization and stratification has as a result a complex deposition of faunal remains. Particularly in multi-period sites, a random sample of social complexity in the collected bone remains is extremely difficult to achieve, even if that is a primary goal of excavation. Thus a serious problem facing the interpretation of all faunal remains from complex sites is determining how representative of an entire community the collection of bones under study is. For instance, Hecker (1982) has argued that pork may have been the food of the lower socio-economic strata of ancient Egyptian society during some periods. If that rule or some variant of it applies, it is likely that a quantitative estimate of abundance for pork expressed for a whole site (e.g. 20% pig at Site A in Period A) will at best only faintly represent much more important within site variability.

The activities which surround different areas of sites also bias the way bones are deposited. For instance Horwitz (1987) has observed that while pig remains are found in early second millenium BC 'Emeq Refaim domestic areas, they are absent from the associated tombs at Givat Masu'a [the specific period is labeled by various authors as Early Bronze IV, Middle Bronze I or Intermediate Bronze].

A number of methods have evolved to deal with these problems of inter- and intra-site variability which bias comparisons of species relative abundance (Hesse and Wapnish 1985). All are quantitative evaluations of bone element counts (or transformations of those counts) placed in comparison to the postulated

effects of hypothesized biasing factors [see, for example, the segregation of the debris associated with slaughter from that of butchering suggested by Hellwing and Gophna (1984)]. For the purposes of this review, the caution the examples provide is more important. Samples of pig bones from Palestinian archaeological sites large enough to bear such analysis have been found only infrequently. It is even rarer to find zooarchaeological samples published in a way that biases of this sort can be detected. I will usually have to rely on simple abundance statistics which purport to represent whole sites and periods, and hope for the best.

ARCHAEOLOGICAL PATTERNS IN PIG PRODUCTION

My following discussion of the pig remains in archaeological sites is largely limited to Cisjordan so as to focus on the use of swine in the immediate environment of Canaan. Additionally the review is restricted to the latest prehistoric periods and the Bronze and Iron Ages, a span from about 4500 to 500 BC. Almost all estimates of abundance offered here are percentages of the total number of identifiable bone fragments in a sample which came from pigs (variously abbreviated in the literature E, TNF, or NISP). A few are expressed with the relative frequency statistic (RF). This estimator attempts to correct for some of the inherent biases of TNF (Hesse and Wapnish 1985). RF is closely correlated with TNF and both avoid the bias of the statistic Minimum Number of Individuals, which tends to overestimate the abundance of rare taxa. Given the variability in samples collected by a host of excavation teams over many years, the values for pig abundance tabulated here should be taken only as rough estimates of actual levels of exploitation.

Chalcolithic and Early Bronze Age—ca. 4500-2000 BC.—The argument that the importance of boar hunting and swine herding is closely related to the distribution of rainfall and suitable terrain is corroborated in the scatter of samples that are available from the Chalcolithic (Table 1, Fig. 1). A number of sites of this period in southern Canaan have no pig bones at all reported: Horvat Beter (Angress 1959), Bir es Safadi (Josien 1955), Bir Abou Matar (Josien 1955) and Shiqmim (Grigson 1987). However, Ducos (1968) has described five locales with abundant pig remains: Tel Aviv (Jabotinsky Road), Metzger, Wadi Gaza, Gat Govrin, and Munhatta. Gilat is another pig-rich site in the Chalcolithic—a deposit that assayed 18% pig (Grigson 1987:235, Table 7-2).

Grigson (1987:231) argues that the distribution of Chalcolithic pig use corresponds to the probable ancient location of the 300 mm isohyet. This precipitation line effectively divides the Negev into those areas where sedentary rainfall agriculture is possible and those where migratory pastoralism coupled with seasonal agriculture based on simple water control was necessary.

Although animal remains have been reported from only a few Early Bronze Age sites (Table 1, Fig. 1), they come from most of the region. Some of the variability is linked to the distribution of ideal pig habitats. For instance Horwitz (1985) reports that the sample from En Shadud contained 24% pig. This site is located in the Jezreel, the great fertile valley that forms the southern boundary of the

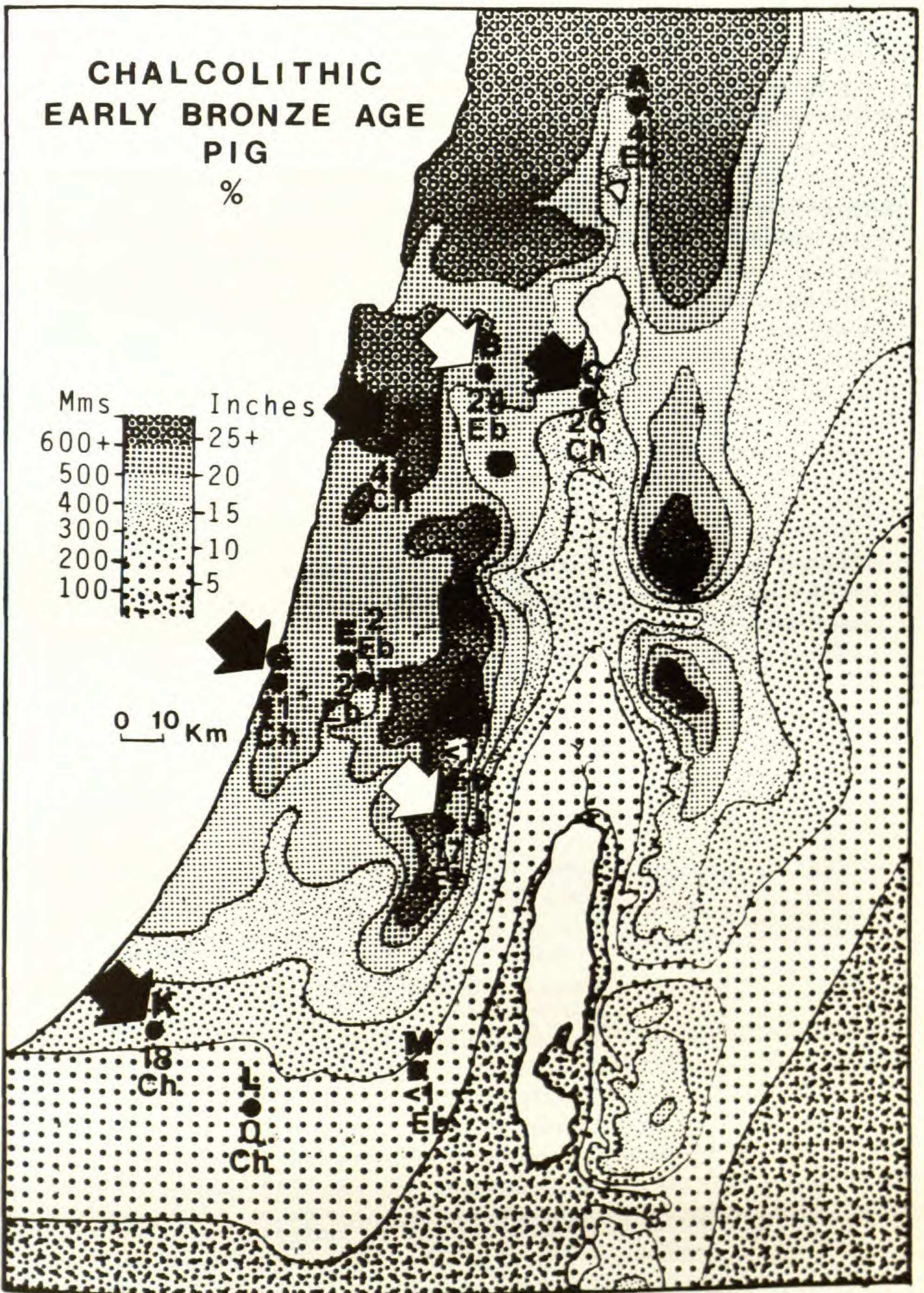


FIG. 1. Chalcolithic and Early Bronze Age Pig Abundance. All maps were prepared by Nancy Carney-Barnhart and Lester Barnhart. A. Dan, B. En Shadud, C. Manhatta, D. Metzger, E. Aphek, F. Dalit, G. Tel Aviv, H. Ai, J. Refaim, K. Gilat, L. Shiqmim, M. Arad.

TABLE 1. *Chalcolithic and Early Bronze Age Pig Remains. (4500-2000 BC).*

In almost all cases the abundance of pig is estimated by the total number of fragments assigned to this taxon (variously abbreviated E, NISP, or TNF in the literature). In a few other cases, the relative frequency statistic (RF) is reported. This measure attempts to correct for some of the obvious biases of the other statistics (see Hesse and Wapnish 1985 for a discussion), has the advantage of forcing attention onto the way a taxon is represented in a collection, but is not a panacea. Thus the percentage values reported here should be treated cautiously as measures of tendency and little significance assigned to small numerical differences.

Site	Reference	Location	% Pig	Sample
Chalcolithic				
Abundant Pig				
Tel Aviv	Ducos 1968	Cent. Coast	11%	599
Metzger	Ducos 1968	Carmel	44%	394
Wadi Gaza	Ducos 1968	S. Coast	18%	210
Manhatta	Ducos 1968	Jordan V.	26%	358
Gilat	Grigson 1987	Negev	18%	291
Rare/Absent Pig				
Horvat Beter	Angress 1959	Negev	0	
Bir es Safadi	Josien 1955	Negev	0	
Bior abou Matar	Josien 1955	Negev	0	
Early Bronze Age				
Arad	Lernau 1975a	Negev	.3%	1793
Arad	Davis 1976		0	
Aphek/Dalit	Hellwing & Gophna 1984	Coast	1.8%	1488
Ai	Hesse & Wapnish, unpublished	Central Hill	.2%	867
Dan	Wapnish & Hesse, n.d.	Galilee	4%	253
En Shadud	Horwitz 1985	Jezreel	24%	97
Refaim	Horwitz nda	Central	17%	259

Galilee and links the Mediterranean coast and the Jordan Valley. In contrast, from Arad, a large walled town at the arid northern fringe of the Negev, there are two reports (Lernau 1975a, Davis 1976), both indicating little use of pigs. In environments intermediate between these two extremes intermediate abundances of pig prevail. Evidence comes from two sites at the margin of the coastal plain and the hill country which forms the spine of Palestine—Tel Delit and Tel Aphek. Hellwing and Gophna (1984) report 1.8% pig in a combined sample which merges

the remains from the two tells. Since these two sites occupy somewhat different environmental zones with Tel Aphek located in somewhat better pig country, this average may not accurately reflect either site alone. Similarly, the Early Bronze Age sample from Ai, located in rough country to the north of Jerusalem overlooking the Jordan Valley from the west, contains only a trace of pig, nine pig bones among 876 identifiable fragments.³ Evidence of this sort has led Horwitz and Tchernov (1988) to conclude that the frequency of pig declines from north to south in general agreement with the degree of aridity, matching the pattern for cattle and contrasting with that of goats.

There are interesting exceptions to this environmental linkage that point to other pig theories. An important example is discussed by Horwitz and Tchernov (1988). Samples from a site in the Refaim Valley near Jerusalem, in an environment more comparable to Ai than En Shadud yielded 17% pig (Horwitz n.d.a). Further, excavations at Tel Halif, located to the north of Arad (site "L" in Fig. 2) have recently produced evidence of an emphasis on pig exploitation in the Early Bronze Age (Melinda Zeder, personal communication). Zeder suggests that the size and complexity of the site is inversely linked to the use of pig in a manner similar to what was observed in the Middle Bronze Age by Hesse, Metzger and Henson (1986), that is, a pattern in agreement with the political model for pig avoidance—more urbanized towns having less pig use, with rural communities depending on them. This principle could also account for some of the difference in pig abundance between large walled Ai and the tiny Refaim Valley sites.

It is possible to use the Refaim Valley remains to evaluate the pig theory that is based on cultic disdain. In this locale close by Jerusalem, the pigs were recovered only in the domestic debris and never as offerings in the contemporary tombs, although other species were. This example suggests that the pig may have been avoided, rather than sought after, in sacred affairs.

One can add to these unexplained anomalies the relative lack (only about 4%) of pig remains at Tel Dan, a site located in prime pig country. So little is known about the extent of Tel Dan in this period that I cannot speculate whether the political theory may apply there as well.

Middle and Late Bronze Age—ca. 2000-1200 B.C.—Religious theories are useful in interpreting the pig bone sample from the second millennium BC (Table 2, Fig. 2). Most of the evidence from these periods come from complex sites where several periods are represented. One sample—from Sasa in the Upper Galilee (Horwitz 1987)—comes from a tomb dated ca. 2000–1600 BC. Of the 62 bone fragments recovered, 11% were pig. This association of pigs with non-domestic contexts fits nicely with de Vaux's report of pig bones in a subterranean 'cultic' structure at another northern site, Tell Far'ah North (Tirzah) and contrasts with the earlier situation in the Refaim Valley. Thus, though recently doubt has been cast on the ritual significance of the Tirzah building (P. Wapnish, personal communication), these bones provide a thread of support for the theory that the prohibition of pigs originated in disdain for cultic practices—at least someone was using pigs in a ritual setting.⁴

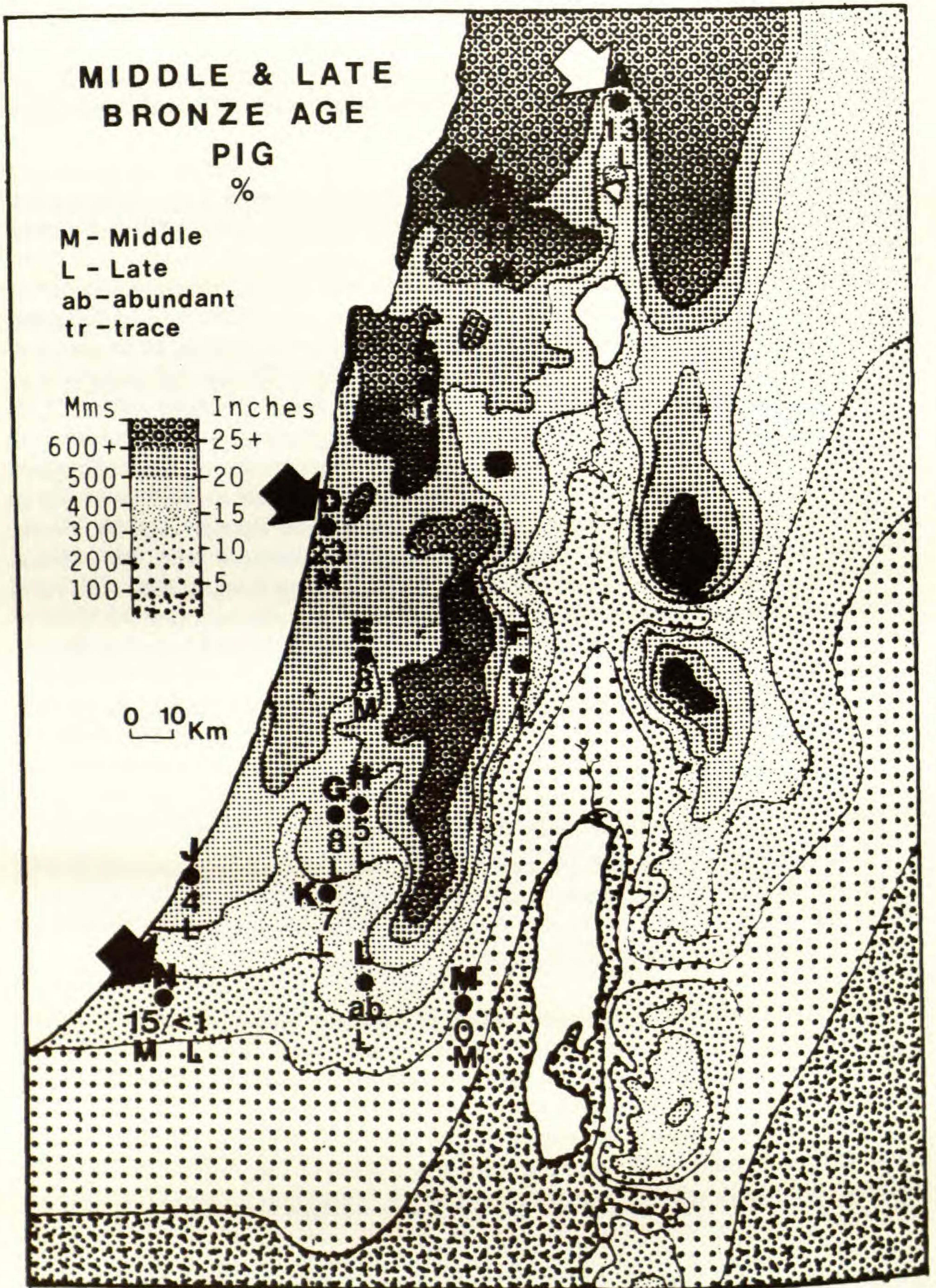


FIG. 2. Middle and Late Bronze Age Pig Abundance. A. Dan, B. Sasa, C. Megiddo, D. Ifshar, E. Aphek, F. Shiloh, G. Migne, H. Batash, J. Ashkelon, K. Lachish, L. Halif, M. Jebel Qa'aqir, N. Jemmeh.

TABLE 2. *Middle and Late Bronze Age Pig Remains. (2000-1200 BC)*

The ratio between the main exploited species is provided when it could be calculated from the literature. A good deal of the variability in the proportions of the larger cattle to the smaller sheep, goats, and pigs is due to variability in the collection methods used over the last several decades at these sites.

Site	Location	% Pig	Sample	Pig:S/G:Cattle
Middle Bronze Age 2000-1550 BC				
Jemmeh	S. Coast	12% (RF)	2500	1 : 7 : 1
Wapnish & Hesse 1988				
Aphek	C. Coast	8%	1129	1 : 6 : 4
Hellwing & Gophna 1984				
Ifshar	C. Coast	23%	1491	1 : 2 : 1
Henson 1988				
Sasa	Gililee	11%	62	tomb deposit
Horwitz 1987				
Hayyat	Jordan V.	34%	3500	3: 4: 2
Hesse, Metzger & Henson 1986				
Late Bronze Age 1550-1200 BC				
Halif	N. Negev	Common	??	???
Zeder 1983				
Dan	U. Galilee	13%	54	1 : 1 : 3
Wapnish & Hesse nd				
Shiloh	Cent. Hill	trace?	2332	t : 13 : 1
Hellwing & Sadeh 1985				
Lachish	S. Hill	6%	53	1 : 5 : 10
Lernau 1975b				
Lachish	S. Hill	7%	??	1 : 10 : 3
Tchernov & Drori 1983				
Jemmeh	S. Coast	.3%	3950	t : 5 : 1
Wapnish n.d.				

"t" indicates a trace, when this is the estimate of pig in the sample, the ratio between sheep/goat and cattle ignores this small pig sample.

On the other hand, other Middle Bronze Age evidence suggests that some communities practiced ritual avoidance of pigs. Middle Bronze Age I samples from tombs at Jebel Qa'aqir located near Hebron produced no pig bones in association with the burials. Further in the evidence from Tell el-Hayyat in the Jordan Valley (not shown on the map but located across the Jordan River and slightly to the north of site "F"), pig bones are common in the domestic debris from this village, which is roughly contemporary with both tomb sites, while almost none were found in the sequence of temples excavated at the site (Mary Metzger, personal communication). This small scatter of samples is suggestive of a regional pattern.

Hopefully additional excavation will determine whether "cultic" pig use was a "northern" behavior while pigs were disdained in Jordan Valley ritual settings.

Political and social class factors also may contribute to the distribution of pig exploitation in the Middle and Late Bronze Age. The Middle Bronze Age collection from Tell Jemmeh (Wapnish and Hesse 1988:85-86) includes 12% domestic pigs in a sample of domestic debris found in modest dwellings. In the Late Bronze Age, the number of pigs in the sample plunges to less than 1%, though the evidence based on bird remains indicates that relatively wet conditions persisted in the local catchment (Wapnish 1990). The architectural and historical context of these samples suggests an explanation. The Late Bronze Age faunal material comes from a place or public building and is mixed with ceramics the excavator describes as elite (Gus Van Beek, personal communication). Tell Jemmeh is also located on the southern coastal plain of Palestine and was dominated by Egypt during both periods. If Hecker (1984, 1982) is correct about pigs being the food of the working and lower classes in Egypt during the Late Bronze Age, then the patterns at Tell Jemmeh may reflect the establishment of dietary behavior and perhaps food rules based on Egyptian social stratification.

Comparison of the abundances of pigs at several sites in the Middle Bronze Age suggests that the rural-urban dichotomy may also account for some of the variability. To the 12% value for pigs at Tell Jemmeh can be added 8% for Tel Aphek, located on the inner coastal plain (Hellwing and Gophna 1984), and 23% for Tel Ifshar, situated farther to the north and closer to the coast (Henson 1988). Finally the sample from Tell el Hayyat, located near the east bank of the Jordan River, contains in the domestic areas about 34% pig. The contexts from Jemmeh, Ifshar, and Hayyat are all roughly comparable domestic debris. Assuming that the behavioral contexts of the Aphek material are not totally different, we made some comparisons and found two relationships (Hesse, Metzger and Henson 1986). First, the Middle Bronze Age pig proportions are linked to the relative wetness of the environments surrounding each site, a condition also measured by the sheep/goat to cattle ratio—7:1 at Jemmeh, 6:4 at Aphek, 2:1 at Ifshar, and 2:1 at Hayyat. Second, there is a strong inverse correlation with site size—the larger the site, the fewer the pigs. Aphek is about 25 acres while Jemmeh covers 12.5, Ifshar only 5, and Hayyat 1.2. This distribution indicates to us that pig production was a rural subsistence strategy in the Middle Bronze Age.

Further evidence of the rural-urban split comes from the work of Zeder (1983) at Tell Halif, a site located at the southern limit of the central highlands of Canaan. She notes a sharp increase in pig remains in the Late Bronze Age, a trend paralleled by increases in the exploitation of hunted animals. Both trends can be characteristic of a community relying on its own productive systems rather than obtaining food indirectly from market centers (Zeder 1983). Since the site apparently was a special purpose site in that period and was involved with donkey management to a great degree, this seems to support the rural theory for the distribution of pig production. Tel Dan has also produced a Late Bronze Age sample of 54 identifiable bones of which seven were pigs (Wapnish and Hesse n.d.). The proportion of deer in the sample is high (about 25% of the bones found), a pattern also concordant with the Tell Halif record. However, because textual evidence indicates that deer and venison and other hunted foods may be associ-

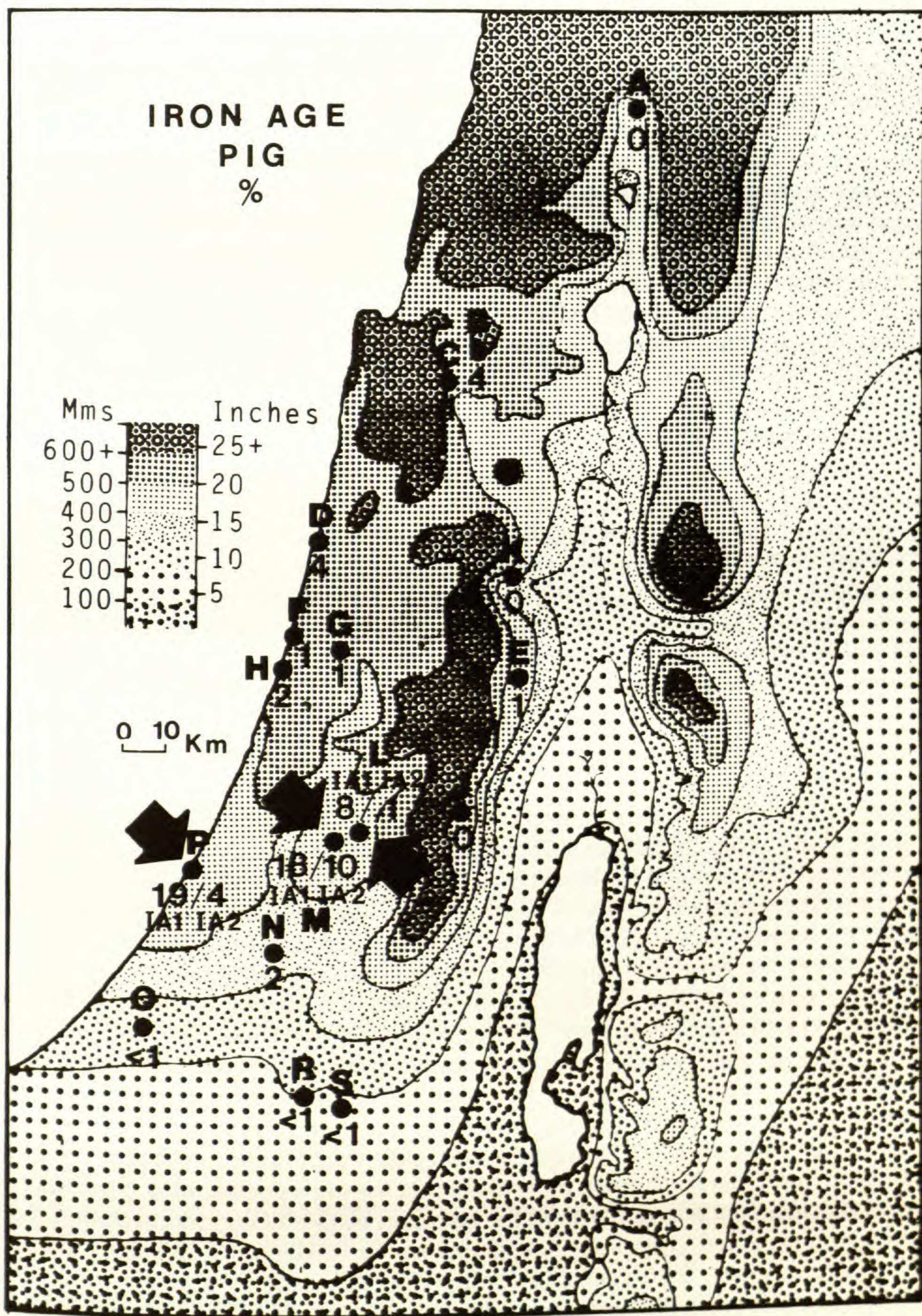


FIG. 3. Iron Age Pig Abundance. A. Dan, B. Wawiyat, C. Qiri, D. Ifshar, E. Shiloh, F. Michal, G. Izbet Sartah, H. Qasile, J. Jerusalem, K. Eyval, L. Batash, M. Miqne, N. Hesi, P. Ashkelon, Q. Jemmeh, R. Beersheba, S. Masos.

ated with elite social classes in Canaan, this statistic may mislead as evidence of economic decentralization. The situation is made more complex by our inability to demonstrate conclusively the domestic or wild status of the Tel Dan pigs. While domestic swine may imply household production, if the pigs were wild, the abundance of pig bones may simply be a byproduct of an increased demand by the elite for wild game for the table and the success of the hunters who supplied them.

Late Bronze Age pig bones from domestic deposits in several other sites have been reported, but are difficult to interpret. The report on the remains from Shiloh mention that pig bones were found but do not specify the period (Hellwing and Sadeh 1985). Given the values in their Table 2, there could not have been many in the Late Bronze Age. From Lachish there are two reports. Lernau (1975b) reports about 6% pig in a sample of 53 bones dominated by cattle. Tchernov and Drori (1983:217, Fig. 28) report about 7% pig in a sample dominated by sheep and goats. Perhaps differences in sample size, sampling methods or within site variability account for these differences.

The Iron Age—ca. 1200–586 BC.—Because the Iron Age is the period of the political and cultural florescence of the Israelites, the examination of the animal bone record for pig related behavior for this period has been most intense. De Vaux's (1972) suggestion that the prohibition of pork was based on an Israelite disdain for neighboring pig lovers was met by considerable enthusiasm in some archaeological circles. In an effort to validate the theory, many scholars focused on a search for the cultic use of pigs, looking for something to which the ancient religious authorities could have reacted.

One often mentioned sample of "pig" bones is the cache of ankle bones, astragali, found in a bowl in Locus 2081 at Megiddo (Loud 1948:44–45), the massive Israelite city in the Jezreel Valley. This collection of bones is part of a group of items of cultic character dated to the end of the 10th century BC (Ottoson 1980: 97–98, Saltz 1978:375, Shiloh 1979:148). It was compared by Lapp (1964:35) to a contemporary cache of 140 bones found at Ta'anach, another important Israelite town and religious center. The Ta'anach collection had been identified as pig bones with the assistance of Crystal Bennett and Lois Glock and this identification was extended to the Megiddo material. Since pig bones are otherwise nearly absent from Ta'anach [also true of Megiddo (Bate 1948), where pigs are represented by only two tooth fragments], Lapp (1967:23) believed that these two extraordinary collections of "pig" astragali must have had a special cultic significance. Perhaps they were examples of apostasy in important Israelite communities—behavior certain to upset the priesthood and perhaps to motivate them to issue ritual legislation. The "cultic pigs" at Ta'anach and Megiddo were used to support the proposition that, "[I]s it not much more likely that the pig's uncleanness is associated with its cultic function rather than the common modernizing interpretation that proscription related to hygienic considerations," a validation of de Vaux's theory.

Unfortunately, as Stager and Wolff (1981:100, note 7) guessed (with the assistance of Patricia Wattenmaker, who examined the published picture of the Megiddo cache), the collection does not contain pigs. Paula Wapnish and the author confirmed this point in an examination of the collection in the Rockefeller Museum of Jerusalem. In fact, of the 684 bones in the collection, 660 are sheep

and goats (7:4), three are from large deer, and 21 are gazelle or roe deer. More generally, no clear evidence of the cultic use of pig in Iron Age Palestine has been found. To the contrary, as will be discussed below, in those Philistine contexts where pigs are common, they are not found in temples or other special contexts.

Iron Age sites in Palestine present a picture of mostly pigless deposits (Table 3, Fig. 3). Considering first the early Iron Age (ca. 1200-1000 BC), the reports from Tel Masos (Tchernov and Drori 1983), Beersheba (Hellwing 1984) and the recent extensive work of Moshe Sadeh (personal communication, June 1988) demonstrate that pig remains are very rare in the Negev. Slightly to the north,

TABLE 3. *Iron Age Pig Remains. IA I — Iron Age I, ca. 1200-1000 BC; IA II — Iron Age II, ca. 1000-586 BC.*

Site	Date / Location	% Pig	Sample	Pig:S/G:Cattle
Pig Poor Samples				
Beersheba Hellwing 1984	IA I / Negev	.3%	1177	t : 6 : 1
Masos Tchernov and Drori 1983	IA I / Negev	.1%	580	t : 3 : 1
Hesi Hesse and Wapnish unpublished	IA I / Shephelah	0%	96	- : 4 : 1
Jemmeh Wapnish nd	IA I / S. Coast	.2%	1396	t : 4 : 1
Qasile Davis 1985	IA I / Coast	1.5%	251	t : 6 : 1
I. Sartah Hellwing and Adjeman 1986	IA I / Inner Plain	.4%	1041	t : 3 : 2
Tel Michal Hellwing 1984	IA I / C. Coast	.7%	???	???
Shiloh Hellwing 1984	IA I / C. Hill	.7%	1333	t : 3 : 1
Dan Wapnish and Hesse nd	IA I / Galilee	0%	77	- : 3 : 1
Wawiyat Henson 1986	IA / S. Galilee	4%	604	4 : 13 : 9
Qiri Davis 1987	IA / Jezreel	1.4%	949	t : 6 : 1
Ifshar Hesse and Wapnish unpublished	IA II / Coast	4%	47	1 : 4 : 12
Dan Wapnish and Hesse n.d.	IA II / Galilee	1% (RF)	286	t : 2 : 3
Jerusalem Horwitz and Tchernov nd	IA II / Ophel	0%	550	- : 5 : 1
Hesi Hesse and Wapnish unpublished	IA II / Shephelah	1.5%	1383	t : 4 : 1

TABLE 3 (continued). *Iron Age Pig Remains. IA I — Iron Age I, ca. 1200-1000 BC; IA II — Iron Age II, ca. 1000-586 BC.*

Site	Date / Location	% Pig	Sample	Pig:S/G:Cattle
Pig Rich Samples				
Ashkelon	12/13 / Coast	4% (RF)	101	1 : 15 : 10
Ashkelon	12th / Coast	19% (RF)	109	1 : 2 : 2
Ashkelon	11th / Coast	5% (RF)	179	1 : 2 : 17
Ashkelon	10th / Coast	4% (RF)	216	1 : 5 : 19
Hesse 1988				
Miqne	LBIRI / Inner Coast	8% (RF)	1007	1 : 9 : 3
Miqne	IRI / Inner Coast	18% (RF)	502	1 : 2.5 : 2
Miqne	IRII / Inner Coast	10% (RF)	153	1 : 6 : 3
Hesse 1986				
Batash	LB / Shephelah	5%	317	1 : 13 : 5
Batash	IRI / Shephelah	8%	231	1 : 8 : 4
Batash	IRII / Shephelah	.9%	914	1 : 67 : 38
Hesse and Wapnish unpublished				

at Tel Hesi no pigs were found in a small sample of 96 identifiable bone fragments. At Tell Jemmeh near the coast pig bones are also very scarce, only 0.2% in a collection of 1392 fragments (Wapnish n.d.). Further to the north along the coast, from a Philistine sanctuary at Qasile, Davis (1985:148) reports 1.5% pig. Hellwing (1984) reports that comparable materials from both Shiloh in the central hill country and Tel Michal along the coast contained 0.7% pig. The small site of Izbet Sartah produced five pig bones from mixed loci (Hellwing and Adjeman 1986:Table 8.2, p. 142). The village is located at the margin of the central hill country and the coastal plain and has been identified as an extremely early Israelite settlement by the excavators. The excavators believe the five bones, which are 0.4% of the 1041 remains in the collection, to be intrusive from Byzantine levels. I was able to find only one pig bone in the collections from the early Iron Age settlements of Ai and Raddana (H on Figure 1) in the spine of the central hill country. The presence of Byzantine material in nearby deposits may also explain this find.⁵ The materials from the controversial site (ritual center or fort?) of Eyval in the northern reaches of the central hill country also contain no pig remains (Horwitz, n.d.b.). At Tel Dan in the Galilee, no pig remains were found in either of the two early Iron age samples from different sectors of the site (Wapnish and Hesse n.d.). Finally, at Wawiyat, a small settlement with substantial architecture located in the southern Galilee, Henson (1986) has found a few pig bones, about 4% of a sample of mostly early Iron Age date.

Expanding the search for pig remains to later phases of the Iron Age as well as to samples not well defined chronologically within the Iron Age just produces more negative results. A confused picture emerges from the excavations at Lachish, at the southern margin of the central hill country. Lernau's (1975b) report mentions no pig bones in the Iron Age or succeeding Hellenistic strata. However,

Bate (1953) described a series of pig skulls coming from a deposit of animal remains that had accumulated on top of human ossuaries. In her report Bate (1953:410) warns that the collections "may be the result of selective collection" since most of the bones sent to her for identification were skulls. Moreover, the presence of a camel in the deposit suggests that the deposit postdates the Iron Age.⁶ Lastly, the most common domestic stock from all periods in Palestine, i.e., sheep and goats, are not recorded at all. Nevertheless, these have been cited as evidence for Iron Age pig use at a Judaeian city (Wright 1964:305). I would suggest this to be another example of the enthusiastic search for the "cultic pig." The characteristics of the collection and its uncertain stratigraphic disposition make it unlikely to reflect Iron Age behavior.

Several locales within Palestine that in earlier periods had extensive pig use show almost none in the Iron Age. Davis (1987) finds 1.4% pig at Tel Qiri, a site in the Jezreel located in an area which in the Early Bronze Age found pig fairly abundant. The same can be said for the site of Ifshar, notable for Middle Bronze Age pig exploitation, where 47 Iron II (1000–586 BC) dated fragments included only two pig bones, both of which seem large for domestic swine. In Iron Age II Tel Dan, four pig bones, all of seemingly wild morphology, were found in 9th–8th century BC deposits (Wapnish and Hesse n.d.). As far as Jerusalem is concerned, a sample of remains from the Ophel produced no pig bones (Horwitz and Tchernov n.d.) but some are present in the City of David excavation materials (Liora Horwitz, personal communication). Finally, a sample of Iron II material from Tel Hesi produced 1.5% (TNF) for 1383 bone fragments.

The question remains, where were the pigs during the Iron Age? So far, three sites (Tel Mique, Tel Batash, and Ashkelon) located on the coastal plain and the edge of the rolling hill country known as the Shephelah have produced parallel patterns of significant pig use (bottom, Table 3). All were important Philistine communities. The initial report on the fauna of Mique, based on the collections from the first two seasons, indicated a sharp rise in the pig remains at the onset of the Iron Age (Hesse 1986). Examination of the material from Batash and subsequent analysis of the 1984 and 1985 collections from Mique confirmed this pattern (Hesse and Wapnish 1987). These results were duplicated in the analysis of the 1985 collection of Iron Age remains from Ashkelon (Hesse 1988). Several comments must be made about the data from Mique and Batash. In the case of the first site, much of the material comes from loci which are well defined stratigraphically but contain ceramics of different periods. A measure of the degree of ceramic mixture was developed for each locus and the locus classified into 12 types based on the relative contribution of pottery of different date. By arranging these types in chronological order and calculating the pig bone content, we could show that there was a distinct peak in the most pure Iron I ceramic materials. Thus the three period breakdown shown in Table 3 blurs and diminishes the actual sharpness of the increase in pig at the onset of Iron I. The same bias reduces the degree of decline in the Iron II materials. In the case of Batash, the size of the increase as reported in Table 3 also blurs and diminishes the increase in pig. A second bias also affects our understanding of the pig use at these two sites. At both tell sites pigs are more common in some architectural contexts than

others. At Miqne pigs are absent from the elite building, perhaps a ritual center (Trude Dothan, personal communication), at the center of the site. I also note in this connection that the sanctuary sample from Philistine Qasile mentioned above also contained few pig bones. At Batash some room complexes are pig rich, other contemporary structures are pig poor (Hesse and Wapnish 1987). Looking at pig rich parts of the site in Iron I yields values of about 14% pig. Pig exploitation was clearly more important for some sectors of these Philistine communities than the simple period percentages would indicate.

The suddenness of the appearance of pig use at the three sites and its correlation with the settlement of the Philistines supports the ethnic theory of pig use. If the Philistines migrated from lands surrounding the Aegean as many theorize, then their pig husbandry may have roots in what had been successful adaptations to their old homeland. Philistine pig use also may have been related to the process of settlement following the pastoral development theory. Since there are no samples from small Philistine sites, the possibility that rural-urban factors were involved cannot be assessed. However, there is evidence that the pig use was structured by social class and none that the animal was manipulated ritually.

The decline of the pig at Miqne and Batash is not well dated. The samples thus far available from both sites fit either rather early in Iron I or late in Iron II. Only at Ashkelon is there a hint that the reduction in the exploitation of pig occurred early in the Iron Age. As a result, I am not able to specify whether the regional decline began as a process associated with the growth and consolidation of the Philistines, the major political changes associated with early Iron II, or the expansion of the olive oil industry in later Iron II, particularly at Miqne. The important point to note is that the use of pig in the Iron Age appears to have been a very restricted event, both temporally and spatially. Nowhere do we see the kind of intense exploitation of the animal found in the Middle Bronze Age.

Post Iron Age Pigs.—The zooarchaeological record for the periods following the Iron Age in Cisjordan is scanty at best. In the late Iron II, Persian, and Hellenistic sample from Tell Jemmeh, pig never accounts for more than 1% of the sample (Wapnish n.d.). At Ashkelon, a small Persian period sample has been studied by Grantham (1988). Of the 118 identifiable bones only three were from pigs. Field readings from a much larger sample confirm this impression. Apparently that was soon to change. Though they have not yet been studied in detail, the samples from the Classical, Byzantine, and Islamic periods at Ashkelon indicate that pork was a mainstay of the diet. This is also reflected in the material reported by Roll and Ayalon (1987:73) from the market place at Apollonia—Arsuf. In Room 557, dated to the 9th c. A.D., the large accumulation of finds included numbers of pig bones. Typically the later periods are marked by abundances of chicken, as well. Textual materials (Urban 1985:149) suggest that the Golan should have been utilized for pig production. However, the only two samples of material (which come from periods later than that specifically referred to by Urban) described, those from Kanaf and Qazrin, include few pigs though substantial amounts of chicken. Qazrin: 0.4% pig in 1684 specimens; Kanaf: 1.8% in 983 specimens (Hesse and Wapnish, unpublished data).

CONCLUSIONS

This paper set out to review the patterns of pig use reported in the zooarchaeological literature to provide a body of descriptive evidence to apply to the theoretical problem of pig avoidance in Palestine. Several patterns of pig use and avoidance emerged. In several periods a link between rainfall and pig use was discovered. This was most clear in the Chalcolithic and Early Bronze Age distributions. In the Middle Bronze Age two possible superimposed processes could be seen. There was some contradictory evidence that pig had some kind of ritual significance—positive based on samples from the Galilee, negative in the Jordan Valley. In addition, there was an inverse correlation between site size and the exploitation of pigs. This agrees with the political model of taxation and anti-pig legislation. This result was repeated in the scanty evidence of the Late Bronze Age. The Iron Age produced a strikingly different pattern. Pigs are only common in the southern coastal plain, the homeland of the Philistines. There they appear almost suddenly and are associated with non-ceremonial architecture and deposits. Later in the Iron Age the use of pigs declines. One datum suggests that this is early in the period. Since the increase in pig coincides with the appearance of the distinctive ceramics of the Sea Peoples/Philistines and because the use of pork may be a major foodway of only some sectors of the communities, it is tempting to link the two causally. Alternatively however, the impact of the Philistines may have disrupted the regular pastoral systems of the south central coastal plain, restricting access to the flocks of the highlands and forcing the inhabitants to fall back on the species best adapted to their environment in the plains, cattle and pigs. Initially, at least, central marketing and administration of the agro-pastoral sector in the region would have been weak, further encouraging independent production. Thus the early Iron Age materials can be used to argue positively for a number of the pig use theories. Finally pigs are little utilized in the later phases of the Iron Age and Persian period. It is only beginning in the classical periods that they are again a mainstay of the urban diet, but only on the coast. No evidence of their use at inland sites has been reported.

To turn this body of data to a consideration of the food proscriptions in the Bible is a thorny problem. The texts, Deuteronomy and Leviticus, which contain the critical laws, are the result of an extremely complex history of editing. Most scholars agree that the form in which we now see these Biblical books was established in the final centuries of the Iron Age or the Persian period. However, there is vast disagreement over what elements of these texts are the result of the final editing process and which reflect cultural traditions of great antiquity. Thus the appropriate historical setting for the first legislation of the pig prohibition is simply not known with any accuracy. From the perspective of the physical evidence of pig use, it is clear that the final editing was done in a period when pork consumption was an almost invisible subsistence alternative. If, on the assumption that rules are not made to prohibit things that no one is doing, that can be taken as 'proof' that the laws are of greater antiquity than the late Iron Age, then two behavioral settings for pig prohibition can be suggested. The Bronze Age data suggests that political centralization may have encouraged the restric-

tion or pig husbandry, a principle that could have been reused as the Israelite polity began to form in the central highlands early in the Iron Age. Alternatively, pig hate can be linked to an important food of the traditional enemy, the Philistines, though this argument is weakened by the lack of evidence that the Philistines were symbolically tied to the animal.

Despite the many reports of bone remains from Palestine, we still have only an outline of the changes which occurred in the pastoral systems which supported the region's successive occupants. In the case of pork production, in particular, because of the relative rarity of pig bones in most samples, much more excavation and description will be necessary to fill in the holes.

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NOTES

- ¹The transition between the Late Bronze Age and the Early Iron Age in the eastern Mediterranean is usually dated to approximately 1200 BC. It was a time of considerable turbulence. Egyptian control of the Canaanite coast was receding and significant new actors began to appear on the political stage. Among the new arrivals, a number of invaders usually lumped under the term "seapeoples," were the Philistines. The Philistines' great rival, the Israelites, also seem to have emerged from Canaanite society and achieved a political identity in the minds of the surrounding nations by this time as well, as an important new interpretation of extra-Biblical evidence suggests (Yurco 1990).
- ²The Iron Age of Canaan is divided into several historical phases. Iron I is the period of Israelite settlement and coalescence into the United Monarchy under David and Solomon. In approximately 925 BC the united kingdom of Judah and Israel divided, an event which marks the beginning of Iron II. Iron II is marked by the steady increase in the power of the Mesopotamians in the region—the capital of Israel, Samaria, fell in 722 BC to the Assyrians, and, finally, the capital of Judah, Jerusalem, was destroyed by the Babylonians in 586 BC (see Miller and Hayes 1986).
- ³This unpublished sample has been studied by Paula Wapnish and the author.

- ⁴Work at the Jordan Valley site of Beth Shean in the spring and summer of 1990 have produced another possible example of "ritual pig." The excavations concentrated on a stratified sequence of temples and in a Late Bronze Age I (ca. 1550 BC) stratum, the remains of what the excavator describes as a "pig barbecue" were found (Amihai Mazar, personal communication). Since I have not seen these remains and they have not yet been published, I am reticent to cite them as conclusive evidence of ritual pig sacrifice. Nevertheless they are potentially extraordinary finds.
- ⁵Because of the untimely death of Joseph Callaway, Zvi Lederman has recently been assigned the task of publishing the Iron Age materials from Ai and Raddana. His preliminary study of the excavation records suggests that the pig bone may be intrusive.
- ⁶In a recent paper Arensburg (1990) has illustrated the non-Iron age, non-Judean character of the human remains in this ossuary.

BOOK REVIEW

A Textbook of Economic Botany. A.V.S.S. Samba Murty and N.S. Subrahmanyam. New Delhi, India: Wiley Eastern Limited. 1989. 875 pp. illus. Rs 90.00 (U.S. \$5.50). ISBN 0-85226-880-7.

This is more than a textbook but just short of an encyclopedic reference to the major economic plants of the world. Emphasis is understandably directed toward the needs of the Indian student at both the undergraduate and graduate levels, but the important species and varieties grown elsewhere are not neglected.

Twenty-five chapters cover the usual gamut of economic crops: cereals, millets, legumes, oil seeds, fibers, lumber, tuber crops, condiments, drug plants and so on; antibiotics and useful microorganisms are also included. Of interest to plant scientists well beyond the University student level are data supplied for each species considered: botanical names, English and local Indian names, origin and distribution (according to Vavilov), ecology, cultivation, soil requirements, processing of the raw material where appropriate, yields/hectare, chromosome numbers, chemical structures when relevant, insect pests, diseases and their management, as well as tables giving Indian and world production.

The book is illustrated with black-and-white photographs, line drawings and maps to add to an understanding of the text. Seven appendices list biochemical tests for major nutritional constituents, Indian research institutes involved in Economic Botany, a table of units used in the text, a list of ornamental plants, Vavilov's grouping of plants according to center of origin and distribution, chromosome numbers, a glossary of terms, and, finally, a comprehensive bibliography and index.